Anterolateral Abdominal wall and Inguinal Canal notes

1. Describe the location of the abdomen. What are the boundaries?

It is the portion of the body between the thorax and pelvis. The abdomen is continuous with the pelvis. The boundaries are the abdominal wall (anterior), diaphragm (superior), plane of the superior pelvic aperture (inferior). Contains abdominal viscera and peritoneal cavity.

1. Describe the components of the anterolateral abdominal wall.

Multilayered musculocutaneous sheet that is anchored to the skeleton of the trunk (at the vertebrae). The anterior portion is the rectal sheath. It is flexible and malleable.

1. Describe the components of the posterior abdominal wall.

Lumbar vertebrae, sacrum, ilium, posterior abdominal muscles, thoracolumbar fascia. This is the only hard structure found in the abdomen\*\*\*\*

1. What is the inguinal canal?

Part of the abdomen that is moved out of the body (the testes).



B

A

C

1. Label the diagram
2. Linea semilunaris
3. Linea alba
4. Anterior Superior Iliac Spine (ASIS)
5. Describe the muscles/fascia relationship. What is the orientation of the muscles?

Most abdominal muscles only have fascia layer in the medial portion, and muscles are in the lateral portion. Muscles are aligned at right angles to each other, but there are also horizontal and vertically oriented muscles

1. What are three physiological functions of the trunk?
2. Bend and rotate
3. Support the trunk
4. Raise abdominal pressure for loud speech, vomiting, defecation and child birth.
5. What is rebound tenderness?

Irritation of deep surface the abdominal wall, causes muscles to contract and therefore limit movement. Small movements of the muscles are doable, but sudden movements cause pain.

1. What can lead to an enlarged abdomen?

Food, fluid (ascietes), fat (superficial or deep), feces, flatus, fetus and tumor.

Use the diagram for the next 2 questions



1. Describe the 4 quadrant system. Name the parts and the lines that transect the body.

2 lines- median plane (the vertical line), transumbilical plane (horizontal line). R/L= right/left. U/L- upper/lower



LLQ

RLQ

LUQ

RUQ

1. Describe the 9 region system. Name the parts and the lines that transect the body.

4 lines- 2 midclavicular lines, 1 subcostal (underneath the ribs) and 1 transtubercular (across the tubercles of the ilium. On the right and left: hypochondriac (H), lumbar (L), inguinal (I). On the median plane Epigastric (E), Umbilical (U), Hypogastric (H).



H

U

E

L I

LL

LH

RI

RL

RH

1. Name the 2 radiological planes
2. Transpyloric plane-(located at L1) where you find pyloric portion of the stomach
3. Interspinous plane- goes through ASIS, lower than the transtubercular plane (it is horizontal)

Use the following diagram for the next series of questions.

1. Identify each of the layers of the anterolateral abdominal wall.



I

H

G

F

E

D

C

B

A

J

1. Skin
2. Superficial fatty layer of subcutaneous tissue (camper fascia)- place where there is a lot of Yellow fat. It is variable in size based upon the amount of fat stored.
3. Deep membranous layer of subcutaneous tissue (Scarpa fascia)- No yellow fat here.
4. Investing (deep) fascia- superficial intermediate and deep. The deep layer (between the internal oblique and transverse abdominis) has the neurovascular bundle.
5. External oblique muscle
6. Internal oblique muscle
7. Transversus abdominis muscle
8. Extraperitoneal fat
9. Endoabdominal (transversalis)fascia
10. Parietal peritoneum
11. What is special about the muscle layers in the above diagram?

They only form fascia in the middle of the body but are muscles in the lateral components.

Muscle Chart

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Name | Action | Attachment(s) | Nerve supply | General Location/Other notes |
| External Oblique Muscle | Combined: Compresses abdominal contents | 1. Inferior Ribs 2. Anterior ½ of the iliac crest 3. Anterior iliac spine 4. Pubic tubercle | Anterior rami of T7-T12 spinal nerves (Thoracoabdominal nerves) | Most superficial muscle of the anterolateral abdominal wall. Muscle mostly located laterally. Same orientation is external intercostals (hands in pockets) |
| Internal Oblique muscle | Unilateral-muscle rotates trunk to same side | 1. Anterior 2/3 of iliac crest 2. Lateral ½ of the inguinal ligament 3. Medial-rectal sheath/linea alba 4. Superior-lower ribs | Thoracoabdominal nerves (anterior rami of T6-T12 and L1 | Located deep to the external oblique muscles, oriented in the opposite direction (at right angles) to ext. oblique |
| Cremaster muscle | Regulates temperature of the testes by raising or lowering scrotum | ?Around the scrotum? | Genital branch of genitofemoral nerve. Cremaster reflex used to test spinal cord function. | Surrounds the scrotum, it is made from fibers of the internal oblique muscle that extend down into the scrotum. |
| Transverse abdominis muscle | No effect on the trunk, it can raise abdominal pressure | 1. Ribs 2. Thoracolumbar fascia 3. Iliac crest 4. Lateral 1/3 of inguinal ligament | Thoracoabdominal nerves (anterior rami of T6-T12 and L1 | Located deep to internal oblique, difficult to tease apart from internal oblique, runs in same direction. |
| Rectus Abdominis Muscle | Flexes the trunk anteriorly | 1. Superior- Costal Cartilage of ribs 5-7, xyphoid process 2. Pubic crest 3. Pubic symphysis at the midline | Thoracoabdominal nerves (anterior rami of T6-T12 spinal nerves) | Located in medial portion of anterior wall of abdomen. |
| Pyrimidalis | Puts tension on the linea alba | Pubic crest and linea alba |  | Located in lower part of rectus abdominis muscle. |

1. What is the rectus sheath?

The rectus sheath represents the aponeuroses of the three muscles coming together as one.

1. What makes up the inguinal ligament? What is the importance of the inguinal ligament?

It is composed of the aponeurosis of the external oblique muscle. It forms a trough to hold the spermatic cord or the round ligament.

1. What is the conjoined(t) tendon?

Aka falx inguinalis, it is made from the aponeurosis of the internal oblique muscle, the aponeurosis attaches to the pectineal line. It is thin and weak, many hernias occur here.

1. What is the importance of transverse abdominis muscle’s attachment?

Since it only attaches to the lateral 1/3 of the inguinal ligament, it does not contribute to the spermatic cord, but it’s fascia does contribute a later to the spermatic cord.

1. What are tendinous inscriptions?

3 bands of connective tissue that break up the skeletal muscles that compose the rectus abdominis muscle. It anchors the rectus abdominis to the rectal sheath.

1. What are linea alba and linea semilunaris?

Linea alba- dense CT that separates rectus abdominis muscles. This is also the location where the 3 fascias from the main abdominal muscles interweave (not rectus abdominal)

Linea semilunaris-Lateral border of rectus abdominis.

1. What is the arcuate line?

It is the crescent shaped inferior border of the posterior layer of rectus sheath, located approximately 1/3 of the distance from the umbilicus to the pubic crest. \*\*occurs at the transition point where the rectus sheath is anterior to the rectus abdominis\*\*\*

1. Describe the relationship between the rectus sheeth and rectus abdominis muscle.

The rectus sheeth is composed of the aponeuroses of the transverse abdominis muscle, internal oblique and external oblique muscles. Above the arcuate line, the aponeurosis of internal oblique and external oblique are anterior to rectus abdominis, while the aponeurosis of transverse abdominal is posterior to rectus abdominis. After the arcuate line, all of the aponeuroses are anterior to the rectal abdominal muscle.

1. Identify the following structures E D F

A

B

C

1. Pectineal Line
2. Pubic Tubercle
3. Pubic symphysis
4. Inguinal Ligament
5. Pectineal ligament
6. ASIS
7. Describe the motor, sympathetic and sensory components of the anterior rami of lower thoracic spinal nerves

Motor- abdominal muscles

Sympathetic- sweat glands, blood vessels

Sensory- skin, muscles, parietal peritoneum

1. Describe the pathway of anterior rami of spinal nerves through the abdomen.

They travel in between the internal oblique and transverse abdominis muscles, then pierce the rectal sheath to supply the rectus abdominis muscle and provide cutaneous branches.

1. Name the specific nerve(s) for: T7-T11, T12, L1. What problem is caused by severing these nerves?

T7-T11: Thoracoabdominal nerves

T12- Subcostal nerve

L1- Iliohypogastric nerve

L1- Ilioinguinal nerve (used in cremaster reflex)

Note: both the L1 nerves are parallel to the inguinal ligament.

Severing these nerves leads to muscle atrophy.

1. Name the following: Where are C/B located?

A



I

H

G

F

E

D

C

B

1. Internal thoracic artery
2. Superior epigastric- found underneath superior rectus abdominis muscle
3. Musculophrenic- found underneath superior rectus abdominis muscle
4. Inferior epigastric-Able to reach rectus abdominis from its location because there is no sheath from the lateral mm.
5. Superficial epigastric
6. External iliac
7. Femoral
8. Deep circumflex iliac
9. Superficial circumflex iliac
10. Describe the proper blood flow in the above diagram

Internal thoracic leads to the superior epigastric and musculophrenic. Superficial epigastric and superficial circumflex iliac branch off the femoral artery, inferior epigastric and deep circumflex iliac branch off the external iliac. The external iliac becomes the femoral after it crosses ithe inguinal ligament. The middle abdominal arteries branch off the intercostals arteries.

1. Label and describe each incision.



E

D

C

B

A

1. Median incision- Incision straight through the linea alba. The linea alba is poorly vascularized, therefore this incision doesn’t heatl
2. Paramedian incision- Near the linea alba but not at the point.
3. Subcostal incision- used in gallbladder surgery
4. McBurney’s point- over the appendix, make a gridiron incision here.
5. Suprapubic- cuts through cutaneous nerves only
6. What is the inguinal canal?

Oblique intermuscular passage through the inferior portion of the anterior abdominal wall. In development it served as a route for the testes to pass from the abdomen to the scrotum. Contains the spermatic cord in males and round ligament in females.

1. What is the orientation of the inguinal canal?

It runs from the deep inguinal ring (laterally) to the superficial inguinal ring (medial), runs parallel and superior to the inguinal ligament along the medial ½ of the ligament.

1. What are the boundaries of the inguinal canal?

Anterior wall- Aponeurosis of external abdominal oblique

Posterior wall- Transversalis fascia, medially reinforced by the conjoined tendon (the union of internal oblique fascia and transverse abdominal fascia)

Floor- Inguinal ligament, lacunar ligament

Roof- Arching fibers of internal oblique and transverses abdominal muscles.

1. What are the crura?

They are located at the superficial ring, they are the parts of the aponeurosis that lie lateral and medial to the ring and therefore form the margins of the rings. The crura are attached together by intercrural fibers which help prevent the crura from separating apart.

1. How does the testis move through the inguinal canal?

Initially the gubernaculums is attached from the testes to the primordial scrotum. This will pull the testes toward the scrotum. Before the testes move, the processus vaginalis will carry muscle and fascia of the abdominal wall into the scrotum area. This allows the spermatic cord to be surrounded by the different muscle layers. Once the testes are pulled through, the gubernaculums shortens and becomes a small attachment from the testes to the wall of the scrotum. The stalk processus vaginalis usually degenerates, but a small part of it remains and surrounds the testicle.

1. Describe the features of the female inguinal canal.

Have a round ligament. The ovary+ the round ligament are equivalane tot eh make gubernacular. The round ligament goes through the inguinal canal, from deep to superficial. The round ligament extends down into the labia majora.

1. What are the contents of the spermatic cord?

Ductus deferens, testicular artery, pampiniform plexus of veins, lymph vessels, nerves.

1. What are the layers of the spermatic cord?
2. External spermatic fascia-composed of external oblique
3. Cremasteric fascia-composed of internal oblique
4. Internal spermatic fascia- composed of transversalis fascia
5. Tunica vaginalis- the remnant of the processus vaginalis is a covering around the testes.
6. What are the layers of the scrotum?
7. Thin skin
8. Dartos tunic- underlying CT that is composed of Colles’ Fascia (continuous with Dartos) and Dartos muscle (smooth muscle cells that in cold temperature cause the scrotum to contract and shrink)
9. What is a hydrocele? Hematocele?

Occurs when excess fluid ends up in a persistent process vaginalis. Can occur either in the cord or the testes. Hematocele is when blood accumulates, spilled by blood vessels nearby.

1. Where is the tunica albuginea?

It is the layer immediately deep to the tunica vaginalis.

1. Describe the blood supply, nerve supply and lymphatic drainage from the testes and epididymus.
2. Blood supply- Arteries originate from abdominal aorta at L2 and are paired on left and right. Venous drainage is not paired because drainage occurs to IVC on the right and left renal vein on the left.
3. Nerve supply- sympathetic L1 and L2 nerves, same pathway as a V/A
4. Same pathway as VAN back to lumbar lymph nodes. Cancers of the testes can be spread to the abdominal wall and not be detected for a long period due to this drainage pattern. The scrotum drains to inguinal nodes, however and leads to earlier detection.
5. Describe direct and indirect hernias.

**Direct**: Leaves the abdominal cavity medial to the inferior epigastric artery (within

the **inguinal triangle)**.Travels anteriorly through the posterior wall of the inguinal canal that is

formed by transversalis fascia and exits via the superficial inguinal ring,hence only the medial portion of the inguinal canal is traveled.Covered by one or two layers of the spermatic cord.

Transversalis fascia forms the hernial sac. Less common than indirect hernias, usually occurs in men older than 40 years.

**Indirect**: Leaves the abdominal cavity lateral to the inferior epigastric artery Travels through the deep inguinal ring, the entire inguinal canal, and the superficial inguinal ring. Originates lateral to the inferior epigastric vessels. Is covered by all three layers of the spermatic cord. The remains of the process vaginalis forms the hernial sac. 20 times more common in males than females.

1. What are the boundaries of the inguinal triangle? What structure is located here?

Medial - lateral border of the rectus abdominis muscle

Lateral - inferior epigastric vessels

Inferior - inguinal ligament - Iliopubic tract

The conjoined tendon is located here, this is pierced through in a direct hernia.

1. Go through the layers of the scrotum (page 13 of notes)

Outermost is parietal layer of tunica vaginalis

Then Cavity of tunica vaginalis

Then visceral layer of tunica vaginalis

Tunica albuginea

Seminiferous tubules (separated by septa)

Note- the epididymis is continuous with the ductus deferens.